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EXAMINER	
LANGMAN, JONATHAN C	
ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/542,951	KALKAN ET AL.	
	Examiner	Art Unit	
	JONATHAN C. LANGMAN	1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 July 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *99-105 and 107-110* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *99-105 and 107-110* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 105 and 107-110 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The applicant claims "wherein one of said plurality of metallic nanocrystals bridges two spatially separated adjacent columns of said array of nanostructured columns". The Examiner was unable to find, support for this limitation in the originally filed specification.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 99 and 102-104 are rejected under 35 U.S.C. 102(e) as being anticipated by or in the alternative under 35 U.S.C. 103 (a) as being unpatentable over Filas et al. (US 6,741,019).

Filas et al. teach Silicon or semiconductor nanowires with diameters between 0.5 and 50 nms and a length of greater than 100nms (col. 3, lines 1-15 and col. 10, lines 50-55). As seen in figure 2b, the nanowires are coated with a magnetic material and drawn to a substrate in order to align the nanowires orthogonally to the substrate (nano columns) (col. 3, lines 18-55). A liquid carrier comprising nanoscale particles of metal such as Ag, Cu, Ni, Fe, and Au, are added to the magnetic coated semiconductor nanowires and deposited onto a substrate. The mixture is then decomposed, sintered or cured (col. 11, lines 1-30). The nanowires have lateral space alignment as seen in the figures (col. 9, lines 30-35).

The nanoscale metal particles that are uniformly dispersed within the nanowires of Filas are taught to be Silver, Copper, Nickel, Iron, and Gold (col. 11, lines 1-15). All of these materials are listed in paragraph [0054] of the PG pub as being suitable metallic nanocrystals for exhibiting surface plasmon resistance. Therefore since Filas teaches similar structures and similar materials to those instantly claimed, it is expected that if the structure of Filas were to be excited, it would exhibit surface plasmon resonance. It has been held that where the claimed and prior art products are identical or substantially identical in structure or are produced by identical or a substantially identical processes, a prima facie case of either anticipation or obviousness will be considered to have been established over functional limitations that stem from the

claimed structure. *In re Best*, 195 USPQ 430, 433 (CCPA 1977), *In re Spada,* 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). The ***prima facie*** case can be rebutted by evidence showing that the prior art products do not necessarily posses the characteristics of the claimed products. *In re Best*, 195 USPQ 430, 433 (CCPA 1977).

Since the nanoparticles of Filas are of the same materials and taught to be uniformly dispersed, and these materials are of the same composition and structure to those instantly claimed, it is inherent that they will exhibit the same material properties instantly claimed i.e. exhibiting surface plasmon resistance.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 100 is rejected under 35 U.S.C. 103(a) as being unpatentable over Filas et al. (US 6,741,019) in view of Debe (US 5,726,524).

Filas et al. teach a structure as described above. Filas teach mounting the structure to a substrate 76 (Figure 6), however are silent to what material the substrate is. Filas et al. are silent to the substrate being glass. However it is known in the art, and taught by Debe, that for Field Effect transistors glass is a suitable substrate (see col. 8, lines 25-30 and col. 14, lines 40-45, for instance). It would have been obvious to a person having ordinary skill in the art at the time the present invention was made to

use glass as suitable substrate for the field effect transistor of Filas, as Debe has shown that these are conventional substrates in the art.

Claim 101 is rejected under 35 U.S.C. 103(a) as being unpatentable over Filas et al. (US 6,741,019).

Filas et al. teach that the nanowires are aligned in an orthogonal manner and spaced apart from each other as seen in the figures (also see col. 9, lines 30-40). Filas et al. are silent to the specific spacing dimensions, i.e., 20 nms apart. However, it would have been obvious to one having ordinary skill in the art at the time of the invention to adjust the spacing to within those ranges instantly claimed, for the intended application, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Claims 99-102 and 104 are rejected under 35 U.S.C. 103(a) as being unpatentable over Debe (US 5,726,524).

Regarding claims 99, and 104, Debe teach an electric field emission device comprising a substrate, with a dense array of discrete solid microstructures. The microstructures are overcoated with an electron emitting material (abstract). The microstructure is taught to be nanorods (col. 8, lines 1-7), with a diameter of 10 to 500 nms (col. 7, lines 55-62). The nanorod material is taught to be semiconducting material, and is also taught to be silicon (col. 12, lines 20-26). Although Debe does not teach

specific examples of the microstructure diameter, lengths, and material as those instantly claimed, they are taught in Debe and would have been obvious choices to a routineer in the art due to their disclosure in Debe.

The overcoated electron emitting material is taught in examples to be Pt (col. 14). The coating nucleates into nanometer sized islands on top of and on the sides of the whiskers or nanorods (col. 13, lines 45-50, also see figures 2A-2C).

As seen in Figure 2b, and discussed at least in col. 14, lines 24-20, Debe shows that the microstructures (nanocolumns) are uniformly covered with isolated nanocrystals of platinum. Platinum is a noble metal that is known to exhibit surface plasmon resonance when in isolated nano crystalline form. It has been held that where the claimed and prior art products are identical or substantially identical in structure or are produced by identical or a substantially identical processes, a prima facie case of either anticipation or obviousness will be considered to have been established over functional limitations that stem from the claimed structure. *In re Best*, 195 USPQ 430, 433 (CCPA 1977), *In re Spada,* 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). The ***prima facie*** case can be rebutted by evidence showing that the prior art products do not necessarily posses the characteristics of the claimed products. *In re Best*, 195 USPQ 430, 433 (CCPA 1977).

Since the nanoparticle of Debe is of the same material taught by Debe and is also taught to be uniformly dispersed as seen in Figure 2b, and these materials are of the same composition and structure to those instantly claimed, it is inherent that they

will exhibit the same material properties instantly claimed, i.e. exhibiting surface plasmon resistance.

Regarding claim 100, Debe teaches that the substrate is preferably glass (col. 8, line 30).

Regarding claim 101, Debe teaches a dense array of microstructures. According to Debe, a dense array means "wherein preferably the mean spacing is approximately equal to the mean diameter of the microstructures" (col. 4, lines 45-50). Since Debe teaches the same diameters as instantly claimed (greater than 10 nms), then the range of spacing is greater than 10 nms wherein the instantly claimed range of 20 nms falls within this range.

Regarding claim 102, Debe teaches that the height of the microstructures are 1000 angstroms to 5 microns (col. 7, lines 50-57), wherein the instantly claimed length falls within this range.

Claims 99, and 101-104, are rejected under 35 U.S.C. 103(a) as being unpatentable over Sun et al. "Surface Reactivity of Si Nanowires" in view of Zhang et al. ("Synthesis of Ordered Single Crystal Silicon Nanowire Arrays").

Regarding claims 99 and 104, Sun teaches a method of making metal nanoparticles by the use of SiNW's to reduce the metal salt solutions. Sun teaches Silicon nanowires with diameters of approximately 20 nms (page 6396, col. 2, 2nd paragraph). The SiNW's are immersed in a metal salt solution comprising silver or copper, upon which nanoparticles of the metal deposited onto the sidewalls of the

Silicon nanowires (see figures and pg. 6397, Section III B). The nanowire solutions are mounted onto a substrate (pgs. 6396-6397, Section II).

Sun uses SiNW's that are fabricated by laser ablation techniques. Sun does not teach a technique that will result in a densely packed array of SiNW's.

Zhang et al. teach SiNW's fabricated by laser ablation often results in curved and tangled SiNW's, which hampers the application of these SiNW's. Zhang proposes a template method of forming densely arrayed SiNW's on the order of greater than 10^7 tips/cm^2 (Zhang 1st paragraph). The method actually achieves SiNW's of 10^{10} tips/cm^2 with equal height, uniform diameter, and perpendicular growth to the substrate (3rd paragraph). Zhang also successfully formed SiNW's with a diameter of 22 nms, falling within the instantly claimed range (pg 1239 col. 2, paragraph 2).

A routineer in the art would have appreciated Zhang's SiNW template as an alternative to the laser ablation SiNW's of Sun, since Zhang's technique results in a dense array of Nanowires, which will allow for more sites of reduction of metal salt to metal nanoparticles as taught by Sun. A routineer in the art would have appreciated Zhang's work in that it would also allow for a better control of the diameter of the nanoparticles, since they would be limited to the interspacing of the nanowires.

It would have been obvious to a person having ordinary skill in the art at the time the present invention was made to use the SiNW template formation technique of Zhang as an alternative to the laser ablation technique taught by Sun et al., as Zhang has shown that this technique results in densely packed arrays of perpendicular SiNW arrays for the ease of application in the art.

It would have been obvious to a routineer in the art to combine prior art elements of Zhang, and Sun, according to known methods, in order to yield predictable results such as more nucleation sites for the reduced metal nanoparticles, and better control of diameter size (MPEP 2141 [R-6], KSR International Co. v. Teleflex Inc. (KSR), 550 U.S. ___, 82 USPQ2d 1385 (2007)).

The obvious combination of Sun and Zhang results in a dense array of silicon nanocolumns that are uniformly covered with a plurality of copper or silver nanoparticles. This structure is the same as instantly claimed. It has been held that where the claimed and prior art products are identical or substantially identical in structure or are produced by identical or a substantially identical processes, a prima facie case of either anticipation or obviousness will be considered to have been established over functional limitations that stem from the claimed structure. *In re Best*, 195 USPQ 430, 433 (CCPA 1977), *In re Spada,* 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). The ***prima facie*** case can be rebutted by evidence showing that the prior art products do not necessarily posses the characteristics of the claimed products. *In re Best*, 195 USPQ 430, 433 (CCPA 1977).

Since the nanoparticles of Sun are of copper or silver and taught to be uniformly dispersed, it is inherent that these particles will exhibit the same material properties instantly claimed i.e. exhibiting surface plasmon resistance.

Regarding claims 101 and 102, Zhang goes on to teach that the nanowire diameter and length depend on the pore diameter and growth time of the nanowire. Zhang teaches that the pore diameter and pore density in the templates is easily

adjusted. It would have been obvious to a routineer in the art, to adjust the pore diameter and density, to obtain a desired nanowire diameter and nanowire spacing; furthermore, it would have been obvious to adjust the growth time, in order to adjust the length of the nanowires. It would have been obvious to one having ordinary skill in the art at the time of the invention to adjust the known parameters for the intended application, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claim 103, Sun teaches that first the SiNW's are stripped of their oxide through an HF etch, however during the reductive deposition of the metal nanoparticles, the surface oxide is reformed on the silicon nanowire (pg, 6398, col. 2, first paragraph). This reoxidation reads on the instantly claimed three dimensional surface having an oxide layer underlying said plurality of metallic nanocrystals.

Response to Arguments

112 1st

The 35 USC 112 first paragraph rejections over claims 105 and 107-11 are maintained. The applicant points to Figure 6, the lowest panel, that shows support for the offending language (as to "one of said plurality of metallic nanocrystals bridges two spatially separated adjacent columns of said array of nanostructured columns") that is further detailed in paragraph [0049] of the application publication. No where in [0049] nor in the lower panel of Figure 6, does the Examiner see one of the nanocrystals

bridging two spatially separated adjacent columns. Further elaboration of the Figures and [0049] is needed in order to produce a case for support of the offending claim language.

Filas

The applicant argues that Filas et al. recites the use of a silicon nanowire and that a nanowire is not equivalent to an array of nanostructured columns. The applicant argues that the aspect ratio of the nanowires taught by Filas versus the aspect ratio of the nanocolumns instantly claimed differ; and thus the instantly claimed nanocolumns distinguish themselves from the nanowires of Filas. The examiner disagrees for two reasons.

First the applicant does not claim an aspect ratio in claim 99, and the applicant does not define nanocolumns within the specification to contain a certain aspect ratio. Therefore the applicant's arguments are not commensurate with the scope of the claims. It is the examiners position that any nanowire, nanorod, or nanocolumn, may read on the instantly claimed nanocolumn; as the instantly claimed nanocolumns do not structurally distinguish themselves from the nanowires of Filas.

Second, Filas teaches breaking the nanowires into smaller more manageable portions (col. 5, lines 55-60). The nanowires are then allowed to protrude from the surface of a substrate as seen in Figures 1E, 1F, 4C, 5B, etc. These protrusion lengths are at least 100 nms (col. 10, lines 50-58), thereby falling within the instantly claimed lengths of less than 200nms (2000 angstroms) as claimed in Claim 102. Therefor the

protruding rod shaped nanowires of Filas, with the same dimensions as claimed in instant claim 102, have the same structure and are not patentably distinguishable from those nanocolumns instantly claimed.

The applicant further argues, that independent claim 99 now recites that the plurality of metallic nanocrystals exhibits surface plasmon resonance; and that as the magnetic coatings (reference numeral 14 of Filas et al.) are continuous, any nanoparticles adhered thereto will not exhibit surface plasmon resonance. The nanoscale metal particles that are uniformly dispersed within the nanowires of Filas are taught to be Silver, Copper, Nickel, Iron, and Gold (col. 11, lines 1-15). All of these materials are listed in paragraph [0054] of the PG pub as being suitable metallic nanocrystals for exhibiting surface plasmon resistance. Therefore since Filas teaches similar structures and similar materials to those instantly claimed, it is expected that if the structure of Filas were to be excited, it would exhibit surface plasmon resonance.

The applicant's mere assertions that the continuous magnetic coatings would not allow any nanoparticles adhered thereto to exhibit surface plasmon resistance, is merely attorney arguments not supported by evidence or any technical basis. It is noted that "the arguments of counsel cannot take the place of evidence in the record", *In re Schulze*, 346 F.2d 600, 602, 145 USPQ 716, 718 (CCPA 1965). It is the examiner's position that the arguments provided by the applicant regarding the magnetic coatings of Filas effecting the ability of the metallic nanoparticles of Filas to exhibit surface plasmon resonance must be supported by a declaration or affidavit. As set forth in MPEP 716.02(g), "the reason for requiring evidence in a declaration or affidavit form is

to obtain the assurances that any statements or representations made are correct, as provided by 35 U.S.C. 24 and 18 U.S.C. 1001".

Sun et al.

The rejections over Sun et al. are removed because Sun et al. does not teach an array, which implicitly implies order of the nanostructures. Since the nanostructures of Sun et al. are not ordered, and not set up in an array, the rejections have been overcome.

Claims 101 and 102 over Filas

The examiner apologizes for inadvertently placing the incorrect claim numbers into the headers of the original 102(e) rejection over Filas, and the 103(a) rejection over claims 101 of Filas. The correct headers for the rejections are set forth above, and for reasons of record the rejections are maintained.

Debe

The applicant argues that Debe teaches away from uniformly spaced metallic nanocrystals between the columns of the microstructures and further the efficacy of the structure produced according to Debe as an electric field emission device would make clear to one of ordinary skill in the art that the over coating of platinum, would not represent the isolated metallic nanocrystals necessary to exhibit surface plasmon resonance.

The applicants argue that Debe teaches that the coatings will be deposited with a shadowing effect where the tops are preferentially coated at the expense of the microstructure bases. However, this preferential coating is not seen in Figure 2b, or at least is not to the same extent which the applicant believes it to be.

As seen in Figure 2b, and discussed at least in col. 14, lines 24-20, Debe shows that the microstructures (nanocolumns) are uniformly covered with isolated nanocrystals of platinum. Platinum is a noble metal that is known to exhibit surface plasmon resonance when in isolated nano crystalline form.

The applicants argue that the reliance on teachings for materials other than platinum as seen in column 12, lines 10-20 is submitted to be improper on the basis that this recitation of materials pertains to materials from which the microstructures may be formed. The examiner agrees, and therefore this part of the rejection has been withdrawn.

Sun in view of Zhang

The applicant argues that one of ordinary skill in the art would appreciate that by forming dense structuring of silicon nanowires with equal height, uniform diameter, and perpendicular growth, that these properties of the prior art combination device would hamper uniformly spaced metallic nanocrystal growth between the structures. This position is merely supported by attorney's arguments and is not supported by a technical basis or evidence on the record. It is noted that "the arguments of counsel cannot take the place of evidence in the record", *In re Schulze*, 346 F.2d 600, 602, 145

USPQ 716, 718 (CCPA 1965). It is the examiner's position that the arguments provided by the applicant regarding that the obvious nanocolumn structure of Zhang when applied to the teachings of Sun, would hamper the ability of metallic nanocrystals uniformly forming between the structures must be supported by a declaration or affidavit. As set forth in MPEP 716.02(g), "the reason for requiring evidence in a declaration or affidavit form is to obtain the assurances that any statements or representations made are correct, as provided by 35 U.S.C. 24 and 18 U.S.C. 1001".

The applicant's arguments in regards to claims 105 and 107-111 are found to be persuasive and therefore the rejections in light of these claims have been overcome.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JONATHAN C. LANGMAN whose telephone number is (571)272-4811. The examiner can normally be reached on Mon-Thurs 8:00 am - 6:30 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer McNeil can be reached on 571-272-1540. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JCL

/Timothy M. Speer/
Primary Examiner, Art Unit 1794